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# AN EXPERIMENTAL STUDY OF EXPECTATION<sup>1</sup>

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Psychology uses many terms designating states of consciousness, which are much in need of accurate definition. Such terms as surprise, belief and expectation are often used, but no one has ever carefully analyzed the states which these terms designate. The particular patterns or types of consciousness for which they stand have not been adequately described. The present study attempts to perform this service in the case of expectation. If expectation is a state of consciousness having characteristics which differentiate it from other states, characteristics which constitute it a distinct type, careful investigation ought to disclose these characteristics. On the other hand, if expectation has no constant characteristics which differentiate it from other states, investigation ought to reveal that fact. The experiments reported in this paper were begun in the hope that they would enable us either to give an accurate description of the expectant consciousness, or to prove that expectation has no distinguishing characteristic.

There are plenty of psychological studies which describe the effects of expectation on other mental and physical states and processes. We find described the effect of expectation on reaction time, on perception, on apperception, on feeling, on illusions, on disease and the curing of disease, but we seldom find any attempt to describe the state itself. It is with this

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<sup>1</sup> From the Psychological Laboratory of Cornell University.

description that the present paper is solely concerned, and no reference will be made to the effects of expectation, or to its relation to other states and processes.

An account of the treatment that expectation has received from psychologists in the past is difficult. It has been treated from very different points of view, so that it is not always easy to make out an author's meaning. And such treatment as the subject has received has usually been quite incidental, often a mere mention in the consideration of some other subject. We find it considered under emotion, and also under cognition; it is sometimes called a feeling, sometimes a process or attitude. The reason for this state of affairs is plain. In all the literature, we can find no account of a single experimental study of expectation. Systematic psychologists give it either casual treatment or none at all; and when they have anything to say on the subject, their account seems to be based on general principles, or on observation incidental to the reaction experiment or some other experiment into which expectation enters as a factor. Sometimes, indeed, they may rely on mere psychological tradition; and one may remark that a good deal of psychology is still mere tradition. Psychological interest takes certain directions, and certain fields are more or less carefully explored, until their psychology comes to be written with considerable accuracy. But when the systematist comes to a subject that has not been carefully worked out from the experimental standpoint, all that he can do is to depend on his everyday experience and on what he finds in the literature. This is precisely the case with expectation. There has been only one psychological monograph written on the subject, that of C. Hitchcock; and this was written, so far as one can tell by reading the paper, without the performance of a single experiment.

There are, perhaps, several reasons why no one has yet worked out the nature of the expectant consciousness. In the first place, every one knows what is meant by the term, every one knows an expectant consciousness when he meets it. Why, then, go to any further trouble about it? In the next place, when one goes beyond a mere general account, and undertakes to give an accurate description of the expectant consciousness, one finds this special task as difficult as the general task is easy. One has to deal with the relation of images and kinæsthetic sensations to perceptions and to one another. One has to operate not so much with qualities as with the attributes of clearness, time and intensity. The study of the relative clearness-values and temporal relations of images and kinæsthetic (and other organic) sensations presents unusual difficulty to an analytical introspection. Only a

person of long training and practice in introspection is competent as an observer. The average observer in a psychological laboratory misses the very things that one must know to be able to describe the state of expectation. The kinæsthetic and other organic sensations may even escape his notice entirely. He may speak of images when the actual content of his consciousness is kinæsthetic sensation. It has been the writer's good fortune to have as observers graduate students of several years' experience in introspection. Finally, there has been no great incentive to an analysis of the expectant consciousness. The effects of the state in shortening reaction time, in producing illusion, its effect on discrimination, on apperception, and on association are fairly well known. And since every one knows in a general way what the expectant consciousness is, only one interested in the analysis and description of all conscious states and processes for their own sake could offer an apology for further excursion in this field. Such an interest the author confesses to have, and such an apology he begs to offer.

Although the psychology of expectation has fared badly in systematic psychology, the literature of the subject cannot be neglected. For more than one writer has clearly conceived the nature of the problem, and some have come near to the correct solution. Our treatment of this literature, however, need not be exhaustive. We shall mention only those authors who have had something pretty definite to say. Most recent writers define expectation in terms of attention, and, in particular, as a preparatory attention.

Külpe<sup>1</sup> treats expectation as a form of attention in which one is preparing for a coming state, process or content. This form of attention owes its specific characteristic to certain complexes of organic sensation, and may be either pleasant or unpleasant. The effect of expecting pleasantness or unpleasantness is the same as the effect of attending to these affections, *i. e.*, it reduces their intensity or entirely prevents their arrival. The feeling-tone of an expectant state is complicated by the fact that the idea of the expected impression may have its own specific affection, and the strains and other sensations of the state have also their affective tone. For instance, the idea may be pleasant and the sensations unpleasant. The feeling tone of the state as a whole is then determined by the stronger of these affections. For Külpe, accordingly, expectation is consciousness when one is preparing for an impression that is about to come. This preparation consists in such things as a favorable attitude of the body, an adjustment of the sensory

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<sup>1</sup>O. Külpe: *Outlines*, 1909, 39, 261, 320, 323.

apparatus, the arousing of ideas of the coming impression, verbal ideas of the coming task or judgment, and so on.

Lehmann<sup>1</sup> describes expectation mainly in biological terms, but in so far as he is psychological, in terms of attention. He says that, in expectation, the attention is directed upon an image and also upon an action or movement to be performed. He means, of course, that one attends to the idea of a certain stimulus that is to come and also to the image of a certain movement that is to follow the stimulus. This idea of movement brings about an innervation of muscles, particularly of the muscles which regulate the internal organs, and it is normally these organs that are excited during expectation. However, Lehmann differs from Külpe in holding that expectation is always unpleasant.

Sully<sup>2</sup> agrees in the main with Külpe. He points out the fact, however, that a succession of impressions must previously have taken place if one member of a series of impressions is to call up the idea of the next, and thus cause the next to be expected. And this expecting of the next impression consists merely in the having an idea of it, and in having the proper bodily attitude for its reception, together with a readiness to act in conformity with the occurrence. The conscious aspect of this readiness is strain sensation. Sully speaks of this as a *strenuous activity*, a *stretching forward of the mind*, and differentiates the state from memory, which he calls a passive state of mind, by the characteristic of "tension, effort or strain". Sully also points out that a certain interval of time must elapse after a perception, or the idea of a coming impression will not arise.

Titchener<sup>3</sup> also treats expectation as anticipatory attention, and says that he means attention to the idea of something that is to happen in the future. He points out that the term expectation should be applied to a certain *state* of consciousness and not to an emotion accompanying that state. It is well to have had this distinction made, for it is in this connection that we find most confusion in the literature. Many writers speak of the emotion or feeling of expectation when they really mean the feeling accompanying the strain sensations prominent in the expectant state.

Wundt<sup>4</sup> also considers expectation a state of consciousness in which the attention is directed not upon a present but on a

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<sup>1</sup> A. Lehmann: *Die Hauptgesetze des menschlichen Gefühlslebens*, 1892, 394.

<sup>2</sup> J. Sully: *Outlines*, 253-258.

<sup>3</sup> E. B. Titchener: *Primer of Psychology*, 153.

<sup>4</sup> W. Wundt: *Grundzüge der physiologischen Psychologie*, 5th ed., iii, 346.

future impression. He means, apparently, on the idea of the future impression; for one cannot attend to something not yet in the mind. Wundt finds in expectation three constituents: strains, memory images, and a characteristic feeling of unrest. He considers the feeling the essentially important thing in the expectant consciousness, and says that it becomes painful if the strain sensations are much prolonged. The memory elements, on the other hand, may sink to a lower level of consciousness, from which they *strive toward apperception*. It is, however, difficult to understand how expectation can be a state in which one is attending to memory images, while these images still remain outside the focus of attention.

This striving toward apperception introduces us to Lipps<sup>1</sup> who, in the peculiar terminology of his system, speaks of expectation as a *striving*. According to Lipps, in expectation, an idea is striving toward sensation or perception. In another connection, he calls expectation an associative striving. Lipps seems to mean, interpreted in more familiar terms, that a consciousness whose main content is an image *striving to become* a perception is an expectant consciousness. This striving, which he attributes to the idea, represents merely the strain and other organic sensations which are given in expectation.

Dewey<sup>2</sup> may be mentioned as a representative of those psychologists who have called expectation an emotion. For him, expectation is the feeling that accompanies the stretching forward of the mind. Lipps and Wundt say that expectation is just this stretching forward, this striving; Dewey, that it is the feeling that accompanies the striving, not the striving itself.

Hitchcock<sup>3</sup> who, as mentioned above, has written the only psychological monograph on this subject, considers expectation a state of consciousness in which images or ideas are regarded as substitutes for sensational contents which are to be later experienced. Her article is considered at length on a later page.

In addition to the views given above, there are formal and logical treatments, of which Ward's may be taken as typical. We take no account of those in this paper, since they are theoretical constructions that must be examined and tested by appeal to the facts.

It is evident from this brief outline, that the tendency among psychologists is to regard expectation as a form of attention,

<sup>1</sup> Th. Lipps: *Grundtatsachen des Seelenlebens*, 669; also, *Leitfaden der Psychologie*, 217.

<sup>2</sup> J. Dewey: *Psychology*, 273.

<sup>3</sup> C. Hitchcock: *The Psychology of Expectation*, *Psych. Rev. Mon. Sup.*, v, No. 3.

namely, anticipatory attention. Some authors think that there is a characteristic feeling tone, others that there is no common feeling element.

#### EXPECTATION OF VISUAL STIMULI

*Experiments with the exposure apparatus.* We now turn to the experimental work which was done in the Cornell laboratory during the years 1907-1908 and 1908-1909. At the beginning of the work we made the general assumption that expectation is a state of consciousness beginning with a sensation or perception and followed, after a short interval, by another sensation or perception. The first sensation or perception gives rise to the expectation of the second sensation or perception. We conceive the problem to be, chiefly, the determination of the type or pattern of consciousness which lies between these two sensations or perceptions. What is the mind like when it is waiting? What is it to await a thing with the assurance that it will happen? What is the difference between the relation that exists between two perceptions that are connected by the tie of expectation, and that existing between two perceptions otherwise connected? These were our problems. The direction which the experiments should take was suggested by everyday experience. To give an instance: I stand by my window looking out over the town and see the steam rising from the mill-whistle. I *expect* that in a moment I shall hear the sound of the whistle. Put into general terms, this experience of the whistle is somewhat as follows: An invariable succession of stimuli after a time causes the second to be expected when the first of the series is perceived. We therefore decided that what was needed to solve the problem was to bring the mill-whistle into the laboratory. We planned means of giving the observers an invariable succession of stimuli, not only in the field of audition but also in vision, touch and temperature. We constructed an apparatus that would serve for both vision and audition. This apparatus will be designated the exposure apparatus. It consisted of a pendulum, 130 cm. long, having a large bob of lead. The pendulum swung from a cross-bar of wood mounted with sharp iron points resting on metal plates. The mounting gave practically no friction. By rack and pinion attachments the wooden bar supporting the pendulum was made to move a carriage in the horizontal direction. This carriage carried the stimulus to be exposed, and in front of the carriage was a large black cardboard in which were the exposure holes and slit. From the cardboard hung a black cloth, entirely concealing the apparatus behind. The two exposure holes were  $1\frac{1}{2}$  cm. in diameter, and the exposure slit was 2 cm. wide and 25 cm.

long. The pendulum was held at the top by a clamp and set-screw, so that its length could easily be changed, and therewith the rate of speed of the carriage.

(1) *Expectation of colored stimuli after an auditory signal*

This, the first set of experiments, was performed essentially as follows. The observer was seated about one meter in front of the exposure apparatus, and instructed to look at the hole; behind this exposure-hole the carriage carried a small colored disc, and as a color passed the hole it could be seen by the observer. The carriage, at the beginning of an experiment, was pushed as far as it would go to the observer's right, and the pendulum was fastened to one side, ready to swing, and held in position by a clamp. To release the pendulum the experimenter struck the clamp with a piece of wood. The noise of this stroke was the signal for the experiment to begin. At first, the observer was told nothing about what would happen; he was only to look at the exposure hole. In a very short time, the signal stroke threw the observer into the expectant condition. In order to get the best possible analysis of this expectant state, we varied the experiment in all possible ways. The colors could be known, and the time between the signal and the appearance of the color could be known; the color could be known and the time unknown; the color could be unknown and the time known; or the color and time could both be unknown.

The observers for this experiment were Dr. L. R. Geissler (G), assistant in psychology; Dr. T. Nakashima (N), fellow in psychology; Miss Cheves West (W), fellow in psychology; Miss Helen Clark (C), scholar in psychology; Mrs. Helen Piotrowska (Pi), and Mr. W. S. Foster (F), graduate students in psychology. By the help of an assistant, the writer (Py) was himself able to make several hundred observations.

We give first the results obtained from G.

*Time and color known.* The color used was green. The green was followed in about three seconds by blue. This experiment was repeated 100 times in the course of a month. G's consciousness may be characterized by saying that it consisted almost wholly of verbal ideas; there was an almost total lack of memory ideas, there were practically no visual images of the coming color, and there was no feeling. Only twice was there any hint of an image of the coming stimulus; and, in these cases, there was no color in the image; it had the form of the stimulus but was gray. It may be said, however, that this observer was not visually minded. At the beginning of the experiments, he hardly knew, from his own experience, what a visual image was like. Later on in the work, he frequently got visual images.

Before quoting from G's introspective reports, it is necessary to add a statement of the directions given the observers in regard to their



reports. They were asked to report the contents of consciousness that followed the signal given at the beginning of the experiment. They were also told to describe the contents with reference to the distribution of clearness and intensity and the temporal relation existing among the different parts of consciousness. They were further instructed to report any affective tone that might accompany the ideational content. G, now, gave such reports as these: "I kept saying 'when is the blue coming?' expecting it with every shift of the green. I heard myself saying 'now, this time' and so on, until the color was there."

"I noticed at first that the green seemed to shift faster than usual, but even then thought this an illusion. I noticed quite distinct quivers in my tongue, as if I wished to say something. I interpreted these as tendencies to verbal expression. I began to think of the color blue, this was done in verbal terms, though quite unintentionally. My emotional mood was quite uneven and variable."

"I kept saying 'blue, what is blue like?' After that, I *felt like a conscious blank*. I wondered, finally, why no ideas came to me; there was the staring at the moving color; but noises and organic sensations, which I notice while giving this report, I did not notice while observing. I cannot tell what was in the focus of attention."

"I feel that I am staring blankly at the hole," he reported in one experiment, and added this comment: "From my experience in everyday life, I remember that this has always been so. Before the beginning of a play or concert at the theatre, I am the dullest blindest mind imaginable, often ashamed of it but helpless."

*Stimulus unknown, time known.* In this experiment G. was told what the time of waiting would be, but did not know, in any given case, what the color of the stimulus would be.

G's experience was practically the same as in the preceding experiments, as a few quotations will show. "I was definitely expecting another color of the same size and kind, this in verbal terms. I had no visual images. I asked myself how a red stimulus would look, but no red visual image came. When the stimulus came and was actually red, I had an intense feeling of pleasant relief, but do not remember any organic sensations. The mental processes forming the conscious background were very vague."

"Color came before it was expected. The time interval was vaguely estimated; and after a certain lapse of time, the ideas came 'the next swing of the pendulum will bring the color'; this was muscular or organic."

"This time, the idea of time was most prominent. I was trying to see what the idea was made up of, and this caused the interval to seem somewhat shorter. I said to myself 'it ought to come now' long before it came. I was greatly interested in the idea of time and had no images of color."

*Time unknown, stimulus known and constant.* Nothing new came out in this form of the experiment. The verbal ideas reported usually had reference to the time of appearance of the stimulus.

*Stimulus and time both unknown.* The type of consciousness here was, in general, the same although organic sensations were sometimes reported, especially in the longer waits. G. would say, "For the first time I was conscious of my eyes, and of an effort to keep them fixed on the hole; I felt a little excited organically."

"I had expected, at the very beginning, a blue; this expected blue existed in the form of a verbal idea."

The results obtained from N. were quite different so far as the contents of consciousness were concerned. N. had visual images of the

color where G. had chiefly verbal ideas. N. also had more organic sensations than G. N. seldom reports any verbal ideas. With this observer we performed some 250 experiments, distributed among the four variations of the experiment as described above. His introspections were often more general than were G's. We give typical sentences. When the time and color were known, N. would say: "I had the idea of blue while looking at green." Again, "Strong muscular sensations." "Too much absorbed in green, so that there was not much idea of blue." Again, "At the latter part of green, the idea of blue came in and gave a feeling of satisfaction." Again, "From the early part of green the idea of blue came in, and the attention fluctuated between the perception of green and the idea of blue." N. gave this report many times. He had very vivid visual images. At other times he would say, "From the beginning of the green I had idea of blue while looking at the green." Again, he said, "Vivid but fluctuating idea of blue while looking at the green." In nearly all the above cases, N. reported strain sensations in the eyes. Several times he reported that the memory image of the blue actually mixed with the perceived green and gave him a blue-green. For example, he said, "While expecting the next color there was a fused or mixed color sensation of the present sensation with the expected color, the sensation green with the idea blue." With the stimulus varied and unknown to the observer, while the time was kept constant, N's introspections were much the same. He reported ideas, strain sensations from the eyes and organic sensations. The ideas, however, since he did not know what color was coming, were usually memory images of the color given in the preceding experiment, sometimes ideas of several colors which had been given him in recent experiments. He would, for example, say: "The idea of yellow was present till the appearance of red, whose appearance was very striking because I had never expected that color." Again, he says: "I had memory of what had happened before in the last experiment; it was perfect memory of the order and arrangement of expected ideas, the actual appearance of color and the affection at the time. The appearance of dark brown was strikingly unexpected." N's introspections in the other two types of experiment were not different in any essential. Many of his observations, especially when the nature of the stimulus was unknown, appear not to fall at all into the category of expectation. The signal color would appear and give rise in N's mind to various colors previously seen. Since he seldom speaks of verbal ideas, it is often difficult to say whether he expected any particular color or, indeed, expected anything.

We did not give C. all the variations that were given to the first two observers, but instead passed before the exposure hole a series of four small colored discs on a white cardboard. This series was repeated many times. C. combines, in a measure, the characteristics of both G. and N. After one perception, she would have usually visual images of the coming color and also verbal ideas of it. She seldom reports strain or organic sensation. The colors of the discs were red, yellow, green and blue, and appeared in that order. C. would report: "After the experiment began, and before the first color appeared in the hole, I had visual image of all four of the colored discs; when the first one appeared I had image of the remaining three colors, and so on to the end, and I said the names of the coming colors each time." Again, "I had image of red alone, then of yellow alone, then of green and blue together."

W. was given the same succession of colors as C. The experiment

was not carried very far with her, however, since her experience was much the same as that of N. During the waiting period of the experiment she would have visual images of what was coming; but she reports few organic sensations and also few strain sensations. She would usually give some such report as follows: "I expected the colors in the correct order; had image of them all in a row before the first color appeared."

(2) *The successive appearance of the same visual stimulus*

The purpose of this experiment was to repeat under laboratory conditions a type of experience rather common in everyday life. A piece of colored paper was fastened to the carriage, and passed first by the right and then by the left hole. The interval between the two appearances could be varied by changing the rate of the pendulum. The appearance of the color in the one hole was the signal for its future appearance in the other hole. The difference between this experiment and the preceding will readily be seen. A color appears, then disappears, and in a moment appears again at another place. To see the color the second time, the direction of gaze must be transferred to the second hole. We found this form of experiment one of the most fruitful for a study of the subject, and repeated it many times. There were, however, only two observers, C. and Py.

The usual report of C. was as follows. She would perceive the color in the first hole, and this would be focal until the color moved by and passed out of sight. Then her eyes would move to the next hole and fixate that; frequently there were strain sensations from the eyes, and sometimes more generally from the body. There would arise a visual image of the color coming into view behind the second exposure hole. This visual image appeared in nearly half (41%) of the observations; when it did not occur, kinæsthetic and organic sensations, and also verbal ideas, were always prominent.

In the writer's case (Py), kinæsthetic sensations were practically always present (in 90% of the cases). Organic sensations were present in 70%, verbal ideas in 57%, while images were reported in less than 8% of the observations. Images played a much less important, and kinæsthetic and organic sensations a much more important part, than in the case of C. In the earlier experiments, verbal ideas were more common than in the later. Quotations from the introspections will illustrate this type of experience.

(C.) "Saw the holes, then the red square as it came by the first hole; it seemed to stop there, and I had the verbal ideas 'it is slow'. Then it passed. While waiting for the color to appear in the second hole, I had visual images of the red square crossing the hole. Unpleasant."

(C.) "Saw the holes; saw the color pass the first hole; had image

of the color in the second hole moving a little, not clear; verbal ideas 'it is coming now'; organic sensations from breathing; then color came to the second hole. No feeling."

(C.) "Saw holes and shadows, then color coming; verbal ideas 'it is very slow'; then, before the color came to the second hole, had the verbal ideas 'the holes seem yellow'; no image; rather pleasant."

(C.) "Saw holes; had strain sensations in eyes, organic sensations from breathing; then noticed the second hole; vacant stare till color came; unpleasant."

(C.) "Saw the first hole, second hole in the background; motion of the carriage attracted my attention to the second hole; strain sensations from the eyes; then my attention went to the first hole; saw the color pass; then moved my eyes to the second hole; strain sensations from my eyes again; no image; no feeling."

(C.) "Saw shadows, then color pass the first hole, then visual image of the color passing the second hole, slightly pleasant." And so the reports run. In general, it may be said that the observer moved her eyes to the second hole as soon as the color had left the first hole; then she would often have an image of the color passing by the second hole, unless organic sensations, kinæsthetic sensations, or verbal ideas were in the focus of attention. These four constituents of the waiting consciousness are so vague that when one or two rise to the focus of attention, that is to say, to a fair degree of clearness, the others are very low in clearness-value and often below the limen of consciousness.

The writer's introspections run as follows. (Py) "Saw the first hole; then as the color appeared, I said 'red'; then the left hole was in the focus of attention; there were organic sensations from breathing, and these were slightly unpleasant."

(Py.) "Saw the first hole, heard the noise of the pendulum, fixated the left hole and had strain sensations from the eyes and neck; then saw the red paper pass the second hole."

(Py.) "Said 'now it will come'; then saw the red paper in the first hole; had bodily and eye movements corresponding to the movements of the pendulum; these were felt consciously as organic sensations and kinæsthetic sensations. I began to say 'now it will come'; perception of the left hole and strain from the eyes in the background, organic sensations rather high in the background."

(Py.) "Said 'here it is, now it comes', then my eyes fixated successive portions of the cardboard between the two holes; these fixated portions of the screen were in the focus of attention; next came the verbal ideas 'now it will come', and I fixated the second hole, which then rose to the focus of attention with definite strain sensations from the eyes and neck; then the color appeared in the second hole."

(Py.) "A general strain coming from tense muscles holding the head, neck and eyes still; eyes steadily fixated the right hole; the perception of the right hole was in the focus of attention, then the color, and then the cardboard between the two holes, then the left hole; increasing strain sensations, a quiver in the throat; a suppressed, nascent 'now'; the color appears in the left hole."

(Py.) "Color in the right hole; then verbal ideas 'here it is here it is' as the eyes moved with the pendulum noise, fixing successive points between the two holes; in a short time, quite involuntarily, my eyes fixated the left hole and it sprang into clearness; strain and organic sensations; then came the color." These illustrations are sufficient to show the character of the experience.

## AUDITORY STIMULI

Two classes of experiments were performed with auditory stimuli, (1) with noises and (2) with tones. The first class of experiments was performed with the exposure apparatus. Attachments on the carriage were so arranged that they pushed off steel balls and caused them to fall into a light wooden box, thus producing a sharp noise. The height of fall, and therefore the loudness of the noise, and also the interval between the first and second noises, could be varied at will. The second class of experiments was performed with tuning forks.

(1) *Experiments with Noises*

The general method of this experiment was the same as that first described with colors. The observer was seated before the apparatus and told to listen for sounds. The pendulum was released as before, the blow that released the pendulum making a sharp noise that served for the starting signal. The moving carriage pushed off successively two and, in some cases, three balls. To change the intensity of the sound, we raised or lowered the boxes into which the balls fell. The observers were given the same directions with regard to their introspections as in the case of visual stimuli.

*Observer F.*

While waiting for the sounds, F., after the experiment had progressed for some time, had auditory images (memory images) of the sounds of the falling balls, sensations of strain from the throat as if trying to produce the sounds, and visual images of falling marbles which he imagined the balls to be. He also reported strains about the ears. His introspections run like the following: "After the first noise I had auditory image of what the next sound was to be like, also had visual image of marble falling through hole and dropping into a box." Again: "I looked attentively at the screen, at a place which I thought was directly in front of the marbles, and not at the place whence the sound is to come. It seems as if I wished my eyes to aid my ears. I kept imaging the marbles dropping. Had visual image of the box into which the marbles were to drop, although I have never seen it, and have never seen the mechanism of the apparatus behind the screen." Again: "My sound images were not very distinct; my mind was filled with visual images of what was happening behind the screen; was under great strain." And again: "Had visual images of balls falling." At another time he says: "After the first noise, had very distinct memory image of it; strains in the muscles below and in front of the ears; the image of the sound to come was very indefinite; my *attention was not on it and seldom is*. Had a tendency to make a sound like the coming one, *i. e.*, I had kinæsthetic speech images."

N., while waiting for the second noise, had auditory images of the noise, sensations from the throat in trying to produce the noise, and strain sensations about the eyes and face. He says in his reports: "There were subjectively reproduced sound-sensations from my vocal

organs, as if I was myself producing the expected sound." At another time he says: "In all these expectations there are kinæsthetic sensations from my eyes, mouth and throat, which correspond to those in actually hearing and producing the sounds."

Pi., while waiting for the second sound, had no verbal ideas, but had auditory images of the sound as remembered, visual images of falling and rebounding balls, and strains about the face. The following are typical introspective reports: "Had in memory the succession of sounds of rebounding balls, as in preceding trials." "Attention was on image of the expected sound; there were strain sensations from the teeth which were tightly pressed together, and from lips which trembled a little." "Time seemed longer; there was strain sensation from a slight tension of the limbs, and also sensations from compressed teeth and trembling lips. The sound of the falling balls was clear and pleasant; a faint picture of a silvery ball falling appeared." "Pronounced muscular tension in the upper part of the body, organic sensations from the holding of the breath, strain sensations from twitching of the eyelids; said verbally 'it is coming, coming, coming'."

## (2) *Experiments with Tones*

Three tuning forks,  $c'$ ,  $e'$ , and  $g'$ , mounted on resonance boxes, were used for this experiment. The method of the experiment was to strike the forks in the order  $c'$ ,  $e'$ ,  $g'$ , allowing a short interval between the tones. O sat with his back toward the forks. To introduce uncertainty into the experiment, the observer was sometimes told that the order of the tones would be varied. The time interval between tones, and the intensity of the tones were also varied.

In this experiment, G. always had auditory images of the coming tone, when he knew the order in which the tones would be given, and had sensations from the throat's setting for the next note. He also had visual images of the forks in their arrangement on the table. When he did not know the nature of the coming stimulus, his mind was chiefly filled with verbal ideas, referring to the nature of the coming stimulus.

In this particular experiment, most work was done with C., who made in all about 100 experiments. C. was more variable than was G. Her auditory image of the coming tone was sometimes clear and sometimes obscure. She nearly always had sensations from her throat, as it adjusted itself for the next note. In addition, she had strain sensations more or less general over the body as she waited for the coming note, and she frequently reported organic sensations connected with breathing. In general, after the first tone was given her, she had an auditory image of the coming tone; in subdued manner, she sang the tone herself; and she had strain and organic sensations due to tension of the muscles of the body and to a controlled breathing. This experience occurred when the nature of the coming stimulus was known. The following are typical introspections:

"After the first signal, had organic sensations from breathing, auditory image of coming tone, kinæsthetic sensations from the throat" (5 seconds). "Sensations from throat quite pronounced, organic sensations from breathing, strain sensations from the eyes." [C. often reported a sense of direction toward the forks, and this apparently came from strain sensations in the eyes: time, 5 sec.] "Kinæsthetic sensations from the lower part of the chest, sensations from breathing, auditory image of the coming tone, and strain sensations from the adjusting of the muscles of the throat" (5 seconds). "Kinæsthetic sensations from breathing, general strain sensations from the whole body, strains in the face and eyes and lips." This general strain in the whole body is often reported, and once, when the wait was 15 seconds, C. says: "Organic sensations from breathing almost painful (so long a wait), verbal ideas about its 'being a long time.' Sensations from the throat, and visual image of the forks in their arrangement on the table."

Knowing that he almost never has an auditory image, the writer was curious to know what would characterize his own consciousness while waiting for a tone. He secured an assistant to strike the forks, and acted as an observer in a number of experiments. Not once did he have an anticipatory auditory image of the coming tone. He practically always had organic sensations from suspended or controlled breathing, and usually strain sensations more or less general over the body, and particularly strain sensations in the eyes. He had an image of the forks, in their arrangement on the table, and when one fork was sounded his eyes turned to the next fork—as he saw it in imagery; this turning of the eyes gave slight strain sensations, doubtless the source of the sense of direction.

These experiments, done under laboratory conditions, are in agreement with his general observation of similar experiences for the last three years. Almost every day he has turned his attention to the analysis of an expected sound, usually the library clock striking the hour, or the whistle signalling the weather prediction for the coming day. At such times, the experience begins with the first stroke of the clock or the first blast of the whistle. The body is at once thrown into a characteristic attitude of waiting. This attitude gives rise to strain sensations, more or less general; nearly always there are organic sensations, and sensations from the eyes as they turn toward the source of the expected sound, or as they roll upward as if to cut out all actual visual sensation. If the time of waiting is rather long, there are verbal ideas, sometimes vague, sometimes quite clear. The verbal ideas seem to occur most often when the experience is one whose sequence is not entirely certain, or when the time of wait is several seconds in length. The following are typical reports of introspections in experiments with the forks. (Py.) "Verbal ideas before the first tone; I was not sure that I had heard the signal, and the

verbal ideas were on this point. The first tone came, and then my eyes turned to the next fork; there were strain sensations from my eyes and body generally; on a lower conscious level were organic sensations." Once, when the coming tone was unknown, "I had verbal ideas and organic sensations; these were in the focus of attention alternately. I said, 'now which will it be?' then the body tightened up and gave a general strain, and immediately there came organic sensations." Again, when the wait was long, "I said, 'What next?'" But the turning of the eyes and a general set of the body which followed gave sensations which formed the focus of consciousness. Again, "almost the whole body took part in the wait. My eyes turned toward the forks; there were organic sensations from breathing; general strain sensations; and verbal ideas, such as 'now, there is that tone, the next one is coming'."

#### EXPECTATION OF TOUCH AND TEMPERATURE STIMULI

Only a few experiments of this kind were performed. The results obtained were quite definite, and extended experiments seemed unnecessary. Several methods were used, with four observers. The methods were as follows. The observer sat by a table, with bared arm lying on the table, and eyes closed. For known stimuli, the experimenter would touch the palm of the observer's hand at definite intervals with a cold metal rod. Compass points were also used. First one point would be placed upon the palm of the hand, and then two points; this procedure would be repeated over and over. To introduce uncertainty, the interval was varied and, in the case of the points, the place and order of application. In temperature stimulation, a cold and a warm metal were used, and applied to different places on the observer's arm. In definite expectation, some observers had chiefly visual images and organic sensations, others had strain and organic sensations. When uncertainty was introduced, verbal ideas played a part.

To illustrate this form of expectation, the following quotations may be made from the introspective reports. Pi., when a cold metal was applied to the palm of the hand after constant intervals of waiting, reports, "There was an intense strain before the first application of the stimulus; there was a tingling of the muscles of the palm, they seemed to come upward with a slight tension. After the stimuli began to be applied, there was a feeling of pleasure because of the coolness. [The time of experimentation was July.] The sensation of coolness persisted after the removal of the metal; during the wait between stimulations there was a strain sensation from the slight tension of the muscles of the palm; there was a desire



to feel the coolness again." The observer also reported vague images of the metal which was applied to her hand, but there were no verbal ideas. When the same form of stimulus was applied, with variations of the time and place of application, the observer reports, "Vivid expectation, strains from the trembling palm, pressure image on the palm; there was a startling effect when the stimulus was applied to a different part of the arm; there were strains from different muscles of the body, which twitched. Coolness gave pleasure. When the experimenter's motion was heard, as he moved his arm to apply the stimulus, there were strain sensations from the swelling of the muscles of the arm. There was a vague shadowy image of the experimenter's arm holding the metal, but never any image of the metal touching the arm. Muscular (anticipatory) sensations were always most prominent on the spot last touched. When the arm was actually touched, the cold sensation filled consciousness." This is sufficient to show that tactual expectation, for this observer, consists essentially in strain and pressure sensations or images, organic sensations, and sometimes very vague visual images. In observer W. visual images were more prominent, and in the writer's case (Py.) verbal ideas were prominent, although he had the same strain and organic sensations that were reported by Pi. The experience of observer C. was about the same as that of observer W.

### THE REACTION EXPERIMENTS

Many, perhaps most, of the things which we expect bring about some reaction on our own part. Doubtless, the preparation of the body for the coming stimulus and the consequent reaction have given rise to the peculiar strain and organic sensations prominent in the expectant state. With this belief in mind, we planned a series of experiments in which the observer should receive a signal and then, after an interval, be given a stimulus to which he was to respond as soon as possible by movement. After trying many different forms, we chose the reaction experiment as the most suitable for the purpose. We employed a Sanford pendulum chronoscope with three keys. One of these keys was used by the experimenter, and the other two by the observer. Both auditory and visual stimuli were employed, with four variations: (1) time of wait and stimulus known; (2) time of wait and stimulus both unknown; (3) time of wait known and stimulus unknown; (4) stimulus known and time of wait unknown.

For visual stimulation, small red and green discs were used. They were pasted on a cardboard strip, and concealed from the observer by another cardboard strip in front. When the

experimenter pressed his key, the cardboard in front fell, and the disc was revealed to the observer.

The auditory stimuli were two noises. The one of these noises was produced by striking the reaction key with a piece of metal. The other noise was produced by having fastened to the experimenter's key a clapper which struck a bell when the key was pushed down. Choice reactions were introduced in all those cases in which the observer did not know beforehand the kind of stimulus that was coming; in these the right forefinger was to respond to the one and the left forefinger to the other stimulus.

The method in the four variations was simple. (1) The observer was told that he would be given a certain stimulus after a given time, *e. g.*, that after five seconds from the signal he would be shown the red stimulus, to which he was to react with his right hand. (2) The observer was told that, after an indefinite time, he would be shown either the red or the green stimulus, and that he was to react with the right hand to the red and with the left hand to the green. (3) The observer was told that after a given time, *e. g.*, five seconds, he would be shown either the red or the green stimulus, and was to react with the right hand to red and with the left hand to green. (4) The observer was told that, after an indefinite time, he would be shown a certain stimulus, *e. g.*, red, and that he was to react to this red stimulus with his right hand.

After the reaction, the observer reported his introspections to the experimenter, giving the contents of consciousness in terms of images, sense-perceptions and verbal ideas, together with the affective tone if any were present. The observer was instructed to trace the course of his attention during the experiment, that is, to describe the relative clearness-values of the constituent parts of his consciousness, and also to give, as well as he could, the temporal relations of the processes. Three observers took part in this experiment: G., C., and W. After finishing with these observers, the writer (Py.) acted as observer in a short series of experiments.

The following are summaries of the introspections.

Observer G. *Time and stimulus unknown.* G. got no images when the stimulus was visual, but when the stimulus was auditory he nearly always reported both visual and auditory images; it is to be remembered that, during the experiments with auditory stimuli, the eyes were closed. The auditory images were of the stimulus, and the visual images of the sound-producing instrument. He had images of his own hand with finger on the key, also of the bell, and of the experimenter's hand holding the metal striker. The image of the bell was associated to the image of the left hand on the key (the left hand was to respond to the bell stimulus). The image of the hand holding the metal striker was associated to the image of his own right hand with the finger on the key. There were practically always verbal

ideas, relating to the nature of the stimulus, and also kinæsthetic and organic sensations. The verbal ideas were such as, "Right hand to red and left hand to green," or in the case of auditory stimulus, "Right hand to metal and left hand to bell." The kinæsthetic sensations were strains in the reacting fingers. When the verbal ideas were "Right hand to red", the strain would be in the right fingers and hand, perhaps extending up the arm. And when the verbal ideas were "Left hand to green," the strains would be in the left hand and arm. The organic sensations were in the chest, and were connected with breathing. There was no observable uniformity in the affective tone reported; it was sometimes pleasant, sometimes unpleasant, and often the observation was indifferent. If organic sensations were prominent, the experience was usually reported unpleasant.

*Time known and stimulus unknown.* The results were much the same as in the first type of experiments. There were no visual images when the stimulus was visual, and very seldom even when it was auditory. Organic sensations were always prominent, as were also verbal ideas, while kinæsthetic ideas were only a little less frequent and less clear.

*Time unknown and stimulus known.* There was very little imagery of any kind in this type of experiment, even when the stimulus was auditory. The sensory contents of consciousness were perception of the cardboard shield, verbal ideas and kinæsthetic and organic sensations when the stimulus was visual, while organic sensations and verbal ideas were the prominent contents when the stimulus was auditory. The stimulus as image played very little part in consciousness, which was chiefly kinæsthetic and organic. The stimulus was known, so that there was little concern about it. The body was set for the proper reaction, the breathing was under control, "consciousness was all body".

*Time and stimulus known.* In these experiments there were rarely visual images when the stimulus was visual, but there were both visual and auditory images when it was auditory. The visual images in the latter case were of the key, the apparatus, and the experimenter's hand ready to strike the key. The auditory images were *not anticipatory images*, but memory images of the signal key just after it sounded. That is to say, they were images not of the next constituent of the experience that was being repeated, but of the constituent that had just been experienced in perception. The chief constituents of consciousness were organic and kinæsthetic sensations. The experience was almost uniformly unpleasant if the organic sensations were prominent. This type of experiment was thus different from the others, except that it resembled somewhat the second type described above. There was on the part of the observer, a set, an attitude. After a certain known time, a known stimulus was to come, and a definite reaction was to follow. Therefore, the observer's consciousness was poor in content, except for the organic and kinæsthetic sensations of the set. The organic sensations were always present, and were connected with a controlled breathing. There were often verbal ideas relating to the task, which served evidently to keep the body tense and ready for the reaction. The observer was inclined to call his mind a blank during these experiments.

Observer C. *Time and stimulus unknown.* In the visual experiments, C. usually had visual images of the colors, and also images of the movements of the experimenter and images of the cardboard shield. The images accompanied such verbal ideas as "Right hand to red, left hand to green." There were strain sensations in the hands and fingers, and there were verbal ideas. The experience was usually indifferent.

*Time known and stimulus unknown.* No images were reported in the case of visual stimuli; in the case of auditory stimuli, they were reported in about 50 per cent. of the observations. These images were *not auditory images of the coming stimulus*, however, but were visual patterns of the apparatus, and lines joining the source of a stimulus with its corresponding reaction key. In the case of visual stimuli, the sensory contents of consciousness were verbal ideas and the perception of the cardboard. There were usually noticed strains in the hand whose reaction corresponded verbally with the stimulus. In the case of auditory stimuli, the chief constituents were kinæsthetic sensations. Occasionally these sensations were low in clearness-value, and verbal ideas were prominent.

*Time unknown and stimulus known.* Images occurred in one-third of the visual experiments and in two-thirds of the auditory experiments. The prevailing sensory contents of consciousness were strains in the reacting finger. There were occasionally organic sensations connected with breathing, and some verbal ideas. The experiences were uniformly indifferent.

*Time and stimulus known.* Images were reported. There were kinæsthetic sensations in the reacting finger, but no organic sensations were noticed. The kinæsthetic sensations coincided temporally with images of the hand and finger on the key. Except for the images, C. agrees with G. in this experiment; her consciousness was poor in contents. The experience was uniformly indifferent.

Observer W. With this observer only about half as many experiments were performed as with the other two observers. When stimulus and time were unknown, she had images in about one-third of the observations. The sensory contents of consciousness were cardboard shield, in the visual experiments, with verbal ideas, and kinæsthetic and organic sensations. The organic sensations were from the chest and were connected with breathing. The ideas related to the stimulus, and the strains, were in the appropriate hand and finger. There was usually no affective coloring. When the time was known and the stimulus was unknown, no images were reported. There were verbal ideas and strains in the fingers, all indifferent. When the stimulus was known and the time unknown, there were verbal ideas and strains in the fingers, but only occasional images. All were indifferent. When time and stimulus were both known, images were reported in about half of the observations. The sensory contents of consciousness, in the visual experiments, were perception of the cardboard shield, strains in the reacting finger, and verbal ideas. The experience was sometimes unpleasant, but was usually indifferent.

The writer need give only a brief account of the experiments in which he himself acted as observer. His report is in substantial agreement with the others. His experience in general was as follows. When the stimulus was visual, the cover-card and strains in the reacting finger and in the eyes were alternately focal. As time passed, the reacting finger rose in consciousness to a higher clearness-level, visually and in strain sensations, as well as in pressure from the key. Low in the background of consciousness were organic sensations. Verbal ideas were not prominent, except that they would often occur at the beginning of an experimental series. When the stimulus was auditory, the eyes were closed; then arose a vague visual image of the place whence the ready-signal came, the eyes were turned in that direction; after the signal was sounded, this image passed at once, and there appeared a visual image of the table at which the observer was sitting, and of the apparatus on it. There was also a vague visual image of the experimenter holding the striker, or with finger above

the key. This would rise to the focus and then sink to a lower level, and then an image of the observer's own finger on the reacting key would rise, and with strains from the finger become focal. While *O* was in this stage of the experience, the reacting stimulus usually came; or, in the case of the variable times, attention would shift back and forth between these two sets of images and sensations, and the time of reaction would depend on what was focal when the stimulus came.

It is interesting to note that in the reaction experiments there was little difference in the introspective accounts whether the stimulus was known or unknown. This is in direct opposition to what should occur if the traditional view of expectation were correct. According to that view, expectation is a state of consciousness in which the subject is attending to an image of a coming impression. But we come back to this point later. We must now quote from the introspective records, in order to show the typical expectant consciousness of the reaction experiment.

To quote from some of the writer's introspective reports; when the time and stimulus were unknown, he gave such reports as: "Organic sensations most prominent and unvarying constituent. The breath was entirely under control, the breathing being very slow. I was ready at every instant to react; this in conscious terms was constant strain sensation. There were vague visual images of my hands, with finger on the key. The experimenter made a little noise which served to bring him visually into the background of consciousness, in image of course." There were sometimes verbal ideas, as in the following: "Verbal, 'this will be a long one', 'Now I am ready, I shall always be ready.'" There was visual image of hand and pressure of the finger. The experimenter came vaguely into consciousness visually. There was strain in the eyes [the eyes were directed toward the hands]. Organic sensations, strains pretty general over the body, indifferent." And the following: "Verbal ideas 'now, when will it be?' Noise of the drum, visual image of the finger, pressure and strain sensations at the same time. Every time my finger rose to consciousness in visual image, there was a tightening up of the muscles of the finger, in consciousness strain sensations. The noise of the drum came in at times. There was vague visual image of the experimenter. The time was long and the above experience repeated itself."

In the experiments when all the conditions were known, he would report: "Heard signal, repeated it in throat in some way, noise of drum, then my attention went over to my own table and the whole thing and the apparatus on it came into visual imagery. Then came vague verbal ideas 'it is about time', then the chronoscope came into visual imagery, and my key and finger, then strain in the hand and finger, pressure of the finger, organic sensations from chest." At another time he said, "Caught a bit unaware. I started as usual, I moved over to the reacting experiment and had verbal ideas, 'it will be a little while yet.' I kept my finger tense, however, and had some strain sensations from it, but the stimulus came and found me in the midst of verbal ideas."

Observer C. made such reports as follow. Time and stimulus unknown, time sixty seconds; "After the signal I had feeling of direction toward the instrument; this was essentially sensations from the eyes, that is from eye movement; and the strains in the eyes

lasted for some time; then there were strain sensations in the face. At intervals, I heard slight sounds made by the experimenter; there were kinæsthetic sensations in my fingers. It occurred to me in verbal terms that the experimenter was adjusting the bell, so I thought the stimulus would be the bell. In the background of consciousness were organic sensations from breathing."

Time variable and stimulus noise known: "I heard the signal; then my attention went to image of my reaction key, then to the experimenter's key; I then had image of the experimenter striking his key; I then had kinæsthetic sensations in my own reacting finger, and these lasted till the stimulus came and the reaction took place. The experience was rather pleasant." When all the conditions were known, she would give such reports as these: "Noise of signal key, verbal ideas of its long continued sound; then my attention went to image of my own key, but there were no other images. Indifferent." Again: "Noise of signal, sensations from my reacting finger (it trembled), visual image of finger; then came the reacting stimulus." And again: "Ideas of 'time being short,' strain sensations from the body, more or less general, due to the adjustment of the body, visual image of my key and then of the experimenter and then of my key again."

Observer G. Time (ten seconds) and stimulus known. "Kinæsthetic and organic sensations almost entirely. The noise of signal key set up a strong tendency to react, manifesting itself in strain sensations; these were strong and extended up through the trunk. There were no images." Again: "Mostly sensory, auditory-verbal ideas and pressure of the key on right finger; then as definite visual image as I ever had of the two pendulums starting; then came stimulus." And still again, he says: "Mostly an absolute blank; once there was pressure sensation, and at about the middle of the time, the verbal ideas 'now it will come pretty soon', then there may have been some vague strain sensations in the reacting hand." It is especially to be noted that this observer, although auditory in his general ideational type, had not once an auditory image of the coming noise-impression in the whole series of experiments with auditory stimuli where all the conditions were known. Nor were there any auditory images when the stimuli were varied and unknown to the observer. He reports in such cases: "Funny; definite expectation of the bell consisting in kinæsthetic correlation of the bell and left hand; strong and clear pressure of the left finger on the key strengthened by the verbal ideas, 'this time it will be the left finger.' Indifferent." Again: "Indefinite verbal expectation of either stimulus, 'this time I will not expect either, nor emphasize either'; verbal ideas concerning the time; breathing clear in the background; no images." When all the conditions were unknown, he reports: "The processes are becoming more and more evasive. The kinæsthetic sensations are stronger, being very strong this time in the chest; faint strain from holding self erect; had in verbal ideas expectation of the bell; the cutaneous sensations in the left finger were plainly clearer; the right hand came in verbally once but made no special impression." Again: "Definitely expected the right-hand stimulus. The right hand was emphasized verbally; in spite of this there were strong cutaneous sensations from the left finger. I purposely verbally emphasized the right finger to counterbalance this pressure in the left finger. There was only a vague visual image of the position of the hands." These observations are sufficient to show the general character of the experience.

## EXPECTATION OF WORDS, NUMBERS AND GEOMETRICAL FIGURES

When one listens to a person who is speaking, one often anticipates the words that are coming; and similarly, when one reads, there is often an anticipation of coming words, phrases and even sentences. The purpose of this series of experiments was to discover the form and nature of this anticipation. Is it the same thing as the expectation found in the other experiments?

The method used for these experiments was much the same as that employed for the other experiments with visual stimuli, described above. By means of the exposure apparatus, type-written sentences were slowly moved into view. For this purpose the exposure slit was used instead of the exposure holes, which were closed during these experiments. The slit was on the left side of the large cardboard of the apparatus, and the sentences were moved in from the right. Different rates of movement were employed, and many different kinds of material were taken, such as quotations from standard literature, definitions of psychological and other scientific terms, sentences in German, arithmetical problems such as  $6+9=20-5$ , miscellaneous material, and also drawings and geometrical figures.

G. had, during these experiments, the characteristic expectant attitude of waiting. This attitude, in terms of body, was tension and set of muscles, not only of the eyes, but more or less of the whole body. The attitude was, however, very vaguely expressed in consciousness. In fact it was only by making all sorts of variations in the experiments that accounts of it are brought out in the introspective reports. These variations consisted in increasing or decreasing the rate of speed of the apparatus, or even of stopping it altogether. If the time of wait was very short, few if any of the strain and organic sensations common in the other experiments came to consciousness. However, the repetition of the same sentence, figure or drawing brought about the same sort of experience as in the simple visual experiments with the colors.

There was, further, what might be called a *mental attitude*. The personality of the experimenter served to put the observer into an attitude that was different from what it would otherwise have been. Of the nature of this mental attitude, we shall have something to say later.

When sentences were shown to G., he would, after the appearance of one or more words, verbally complete words and phrases; he would often see the rest of a word, and even more than one word, on the card behind the screen. In some cases, after the appearance of two or three words, G. would complete

the sentence verbally, and often see whole words and phrases on the card behind the screen. This was the simplest method by which G. proceeded. From this method, of plainly seeing and plainly saying the words, there were all degrees of clearness down to vague and unanalyzable processes, apparent short-cuts, appearances of meaning in consciousness in other than verbal terms. Often G. was entirely unable to analyze his experience, and instead gave his report in the most vague and general terms. It was the same in the case of all the other kinds of material used. When an arithmetical statement in type-written form started across the field, G. would *say* and in some cases *see* the rest of it. When a drawing was gradually exposed, G. would verbally comment on what he thought it would be, and in some cases visually complete the drawing in image.

The following quotations illustrate G.'s procedure.

Sentence given: Art is long and time is fleeting. G. reports: "After 'Art is long', had notion that the sense was not very elevating. Can not analyze this notion. When 'and' came, I said verbally, 'life is short', projected 'is' on the cardboard. 'Is must follow', I thought verbally. The tendency to say 'is' was strong. When 'f' came, I said 'fleeting'."

Given:  $2+3+5=5+5$ . G. verbally repeated the first three figures as they were exposed, expected verbally the sign of equality, and after the first '5' appeared, plainly saw in imagery " $\times 2$ ".

Given:  $6+9=20-5$ . G. reports: "I visualized the + sign before it was in sight and said verbally 'equals 15', after the first two numbers appeared. After the 2 of 20 appeared, I said 'equals two plus what?'. When the 20 appeared, I was dead sure visually and verbally that it would be '-5'."

Given: two similar triangles, the one following the other on the paper. G. reports: "I saw, in image, the second triangle completed behind the screen. I was very uncomfortable when the apparatus stopped moving. [The apparatus was stopped in the midst of the experiment.] The stopping of the pendulum entirely changed my waiting attitude; as soon as the pendulum started moving again, back came the old attitude."

Given: Let us then be up and doing. In the experiment preceding, the experimenter had allowed two balls to fall and make a noise. In this experiment G. reports: "Had auditory images of balls falling. Said verbally, 'they must be coming pretty soon [referring to the falling of the balls]. Now, why don't they come?' Then I saw on the cardboard 'Let us' and said 'be happy', but if I really expected it, it was vague and not at all like expecting the balls. There was no idea like 'that will be the next thing on the screen'. I just verbally filled out the sentence from the hint given."

The above difference noticed by the observer is, it seems to us, very important. The observer speaks of the fact that verbal ideas of expectation were absent, and organic and strain sensations are also either weak or lacking. Organic and kinæsthetic sensations and verbal ideas play little part in this experience. And it was the lack of these constituents that



made all the observers hesitate to say that they expected such and such a word or phrase or drawing to appear. In the experiments above described, one or two words would appear, and then the observer would, doubtless more or less mechanically, say certain other words, or perhaps visual images might appear. But there seems to have been no expectation that the word said or imaged would appear, in the same sense that the impressions were expected in the other experiments. In some of the cases with the sentences and similar material, there were present those elements that characterized expectation in the other experiments. For example, if the same sentence was repeated several times over, the experience of the observer was about the same as in the case when colors were shown. The meaning of the thing disappeared, and it was expected in the same sense as were the colored discs.

In anticipating words, then, under the conditions of these experiments, the experience is essentially like that of memory. Suppose, for example, that I see or hear the word "mother". There may rise immediately an image of my mother, and perhaps verbal ideas concerning her; but I should not say that I expected immediately to see her. In such cases there is association without expectation. There is first a sensation or perception, and then at once follows an image or idea of some sort; but this association alone is not expectation; there must be other elements present. These elements, as is already evident, are strain and organic sensations. Suppose that I had a letter saying that my mother is coming to visit me, and that she is likely to come at any moment. I should at once be put into the state of expectation; my body would be thrown into an attitude of strain, and in consciousness the kinæsthetic sensations would be so strong that there would either be no visual image or at any rate the image would not be clear as it is in the case of association.

However, there are, no doubt, all possible degrees of expectancy between this direct association and the cases in which the sensory constituents above mentioned are quite clear. In the experiments with sentences, which we are here describing, there are cases in which there is no expectant element, and other cases in which that element is present. Especially is this true in the case of observer C. Thus C was given the sentence: *Man is mortal, God is an immortal spirit*. C. says that she had "an image of the general appearance of a type-written sentence. Recalled seeing a German sentence on the experimenter's desk, so when 'man' appeared, I gave the German pronunciation for it. I was surprised when 'is' came, for it did not go with the German. Later, when the word 'God' appeared, I said 'immortal'. When I saw 'an', I had a

thwarted feeling and simply waited." It seems that in this experience there was the expectant element, although it was not at all prominent. The experience is analogous to what we have been calling expectation, but is not identical with it. The observer has just seen a slip containing a German sentence. She may or may not have had the verbal ideas "Now I shall be given a German sentence." The word 'man' appears; the observer has been put into the 'German attitude', which means physiologically that certain brain centres or tracts have been called into function; and when the word 'man' appears, the German pronunciation is given without conscious intention, automatically. When *is*, instead of *ist* or some other German word, followed 'man', the observer was 'surprised'. The physical organism was evidently in a different condition from that in which it would have been had the observer not seen the German sentence on the table. But unless this physical condition makes itself manifest in consciousness, unless the muscles are not only *set* but their *set given in consciousness* as strain or organic sensation, it seems best not to call this experience expectation. If expectation is to be the name given to some well-defined pattern of consciousness, then there must be something *in consciousness* to characterize it, something characteristic of the pattern. And as it turned out in this particular case, the physical set or condition of the body served only to bring about one particular association instead of another.

Another somewhat similar experience from the same observer is the following. The sentence given was: Shakespeare was a man and a dramatist. C. thought the first word was 'Shakespeare's' and says: "Expecting something to come that would make sense, said 'plays, Shakespeare's plays'. When 'was' came, I read it right, and after the word 'man' appeared I supplied visually and verbally 'and a dramatist'."

At another time the experimenter had been talking about Longfellow, and quoting the lines beginning "This is the forest primeval". The words actually given to the observer, were: Virgil, Milton, Byron,—all great poets. C. says: "I could hardly get away from Longfellow. I had image of the 'forest primeval'. After 'Virgil,' there was no expectation. After 'Milton,' I thought it would be poets, and supplied verbally 'Shakespeare'. With the word 'Byron', I had the feeling of unfitness, but it is hard to describe this feeling."

After the above, the observer was given the sentence: It is no use to be dogmatically inclined in psychology. C. reports: "At the beginning, I had image of typewritten line, although it was not definite. I said verbally, 'may be it is a line of poetry', and had visual image of the word 'Milton', but I was

not surprised when it did not come. After the words 'It is no use' appeared, I said 'to try', and when 'be dog' appeared, I said 'dogmatic' and supplied, after 'in' the word 'philosophy'. I was only slightly surprised when 'psychology' came instead of 'philosophy'."

### COMBINATION EXPERIMENTS

Finally we performed a number of experiments, which, for the want of a better name, may be called 'combination experiments.' They consisted in the performance, before the observer, of a series of continuous and connected acts. The observer was told to sit quietly, and to say nothing till the end, and then to give as good a report of the proceedings as possible. The results of these experiments were essentially alike, so that only a few of them need be quoted. One was as follows: *E* took cocoa, red pepper and sugar, laid them out on separate papers as a physician does when preparing medicines, mixed the three materials, and put them into a glass of water. *C.* gives the following report. "At first, when the materials were uncovered, I had verbal and visual ideas of the room from which I thought they had come. When the experimenter took out his knife and cut the paper into squares, I had the verbal idea 'powder', and visual image of our old family physician we had when I was a child. While the experimenter was still cutting the paper I had visual image of him putting the powders on the paper and folding it up as a physician does, and had verbal ideas, 'Dr. Pyle,' with tendency to laugh. I really expected the papers to be folded up. At times the perceptions of what the experimenter was doing became low in consciousness and the image of the old family doctor was the clearest thing in consciousness. When the experimenter took the glass of water and put the mixtures into it, I merely watched and wondered if he would try to make me drink it. I said the words 'I wonder if he will try to make me drink it'. I knew he could not make me drink it."

Another experiment performed with *C.* several times was the following. A tin coffee-pot with narrow top was placed on the floor and above it was tied an iron weight. The weight was tied by a cotton string. A piece of paper several inches long was tied to the string. The paper was lighted by placing a lighted match at the end. *C.* says that she "had peculiar strain sensations in every muscle of the body, as I always have in important situations. I imagined the weight would sound louder than it did when it struck the metal below. I had kinæsthetic image of jumping and eyes winking. I had sensations all over the body as I do in apprehension. I do not remember any organic sensation. The strain sensations seem to push

everything else out of consciousness. I should call the experience that of weariness all over the body. I thought the paper would burn longer than it did before it burned the string. I had my eye fixed on a point to which I thought it would burn before it would fall, but the weight fell before the blaze had reached that point."

Two experiments of a similar nature performed with G. were as follows. G. was placed in a chair and told to keep his eyes closed. *E* went out and brought in a large knife and a long cylindrical piece of metal. He rubbed the knife on the metal as if sharpening it, and then slowly drew the back of the knife across the observer's neck. He reports as follows: "I followed the experimenter in visual imagination. When the whetting was going on I followed the scene and waited. I tried to interpret verbally what the experimenter was doing. I would say, for example, 'now he is sharpening something'. There was no thought of what was coming. The mere putting me in a chair, and telling me to wait, puts me into the general attitude of waiting and ready to take whatever comes, a general attitude with no particular image of what is going to come." When this experiment was performed the second time, G. says that he "had organic reverberations of the metal touching my neck before it really touched it." In this latter case, there was expectation. In another experiment with G., *E* deliberately folded and burnt a piece of paper, holding it in his hands till it had burned up. G. reports: "When the experimenter began to fold the paper, I thought he was going to make a small roll for lighting purposes. When the roll was made, I visualized the experimenter taking a match and lighting the paper roll. When the experimenter took his knife and opened it, I said, 'what is all that for? He is trying to scare me.' Then I saw in image the burning of the paper before it was lighted."

It is unnecessary to give more quotations from the results of these experiments. An examination of them shows that there may or may not be expectation in the case of continued performances like the examples mentioned above. The perception of one part of the performance may arouse an association, an image of some other act, but not in all cases is this other act expected. To constitute it expectation, there must be in consciousness something that represents the holding of the body ready for the future impression that a coming act will produce, that is, there must be organic or strain sensations or verbal ideas, either or all of these. Any one of these constituents can serve to keep the organism in readiness for the coming impression, and any one of them in proper temporal and intensive setting gives to consciousness a characteristic pattern.

This pattern, this peculiar state, should be called *expectation*. But before giving a final description and explanation of the state, it will be well to look back over the results of the various experiments, to see what common elements they show, and to determine what conclusions they warrant.

#### INTERPRETATION AND CRITICISM

We have now described our experiments and given a summary of their results. This has been done very briefly. The observers recorded observations sufficient in quantity to fill a volume. But examples have been taken in sufficient numbers to give the reader a fair idea of the whole. We now have to answer the question, What comes out of the results? Does an examination of the observers' reports of experience under all the different conditions reveal any definite pattern of consciousness? And if such a definite pattern is found, does it resemble the experience which people have been accustomed to call expectation? There is no doubt that a definite, unvarying type of consciousness is found from an examination of the results, and this type is always found when we duplicate experimentally those experiences which people agree in calling expectation. There are, however, other experiences much like this type which show no common characteristics. Many of these are also commonly called expectation. Putting it in another way, we may say that if all the types of experience which people are accustomed to call expectation are examined, they fall into two classes. The one type is definite, with constant characteristics arranged in a more or less definite pattern. This type, then, best represents what everybody is accustomed to speak of as expectation. The other class has no definite pattern, no definite characteristic, nothing to distinguish it from many other forms of experience. It is merely a mode of association. These two classes of experience begin in the same way; they begin with a perception. In the second class above mentioned, the perception is followed temporally by one of two different conditions. Either a memory image comes up, forming the focal constituent in consciousness, with no other elements, or at least no prominent organic or kinæsthetic sensations. Or the perception results in the body assuming automatically a definite attitude, without there being any conscious concomitant of this attitude. In some cases, it is hardly proper to speak of this condition as an attitude; the perception brings about a definite response automatically and immediately. In reading, for example, one may *say* a word after seeing a certain other word. The perception of the one word brings about immediately the speaking of the other word, or perhaps the seeing of the other word in image, when one would not

care to say that one *expected* the other word. That is to say, the perception of the first word is followed immediately by the speaking of the second word in an entirely automatic way without any intervening consciousness. Many such experiences are called expectation, but there is nothing whatever in consciousness to distinguish them from experiences that no one would think of calling expectation. We may dismiss these experiences, then, with the statement that they have nothing to characterize them as expectation. Unless an experience has definite attributes, that enables us to set it off from other experiences, it should not be designated as belonging to any special type of consciousness. We shall reserve the term Expectation for a particular type of consciousness, a type that can be described and defined with sufficient accuracy to enable us to distinguish it from all other types or patterns of consciousness. Any classification, of course, must admit some doubtful examples, but the examples mentioned above are certainly not of this doubtful kind.

The nature of this specific type of consciousness, for which we are reserving the term expectation, must already have become clear to the reader. We have several times given at least a partial description of it. We shall now try to define it more specifically and to state the conditions under which it arises. The experimental results as well as general observations show that there are two situations in which the state arises. In the first of these situations, the experience begins with a perception; the subject, after the perception, awaits another perception that in the past has followed the first. This awaiting of the second perception constitutes the expectant state. In consciousness, this state is characterized by strain and organic sensations and verbal ideas. The sensations are ordinarily the main constituents, but the verbal ideas may also be present as a characteristic element, may even be present to the exclusion of the kinæsthetic and organic sensations. Especially when the time of wait is long do the verbal ideas appear and preponderate. Functionally, they serve the same purpose as the initial perception; they serve as stimulus to keep the organism tense and ready for the coming impression, and perhaps for the appropriate response. The verbal ideas take the focus otherwise occupied by the sensations mentioned. The latter often drop only to the background, to a lower level of clearness, where careful introspection usually finds them; or they may drop entirely below the limen of consciousness. In this case, the set of the organism has no definite conscious concomitant, but nevertheless the organism is ready for the coming impression and necessary response. As was pointed out in the discussion of the experiments with sentences, the organ-

ism may be given a 'set' at the beginning of an experiment, a set that serves to bring up a certain group of associations and accordingly a definite expectant response, while this 'set' itself has no conscious concomitant or, at least, lies very low in the background. If the time of wait is short, such cases as these are likely to sink to the level of mere reflexes; not only are the kinæsthetic and organic sensations wanting, but the verbal ideas as well; there is no consciousness intervening between the perception and the response of the organism; such a consciousness is not of the type which we call expectant. In these cases, the 'set' of the organism corresponds to inherited nervous conditions that serve to bring about definite responses upon the appearance of definite stimuli.

An image of the coming impression may or may not be present. It is not essential, and usually it is not present. The focus of consciousness is occupied by sensational elements, and images sink to a low level of clearness-value or are altogether wanting. Some forms of expectation are more favorable than others to the appearance of the image. In the reaction experiment, the image of the coming impression is an unimportant factor, because of the sensational elements. But when one sits waiting for a tone, and no action is to follow the tone, then an image is likely to arise, especially from observers whose ideational type is chiefly auditory; but even with such observers, the strain sensations from the throat may be as prominent as the auditory image, and with the great majority of observers would be the main constituent of consciousness.

If we wished to speculate, we could easily find a biological explanation of this type of the expectant state. There comes a perception which is the first of a series formerly given in our experience. The organism at once assumes an attitude favorable for the reception of the next member or members of the series of impressions. Movements of the body are more or less arrested, the breathing stops or proceeds under control, the eyes are directed toward the source of the expected object of vision, or are averted in order that light sensations may not interfere with perception by means of other sense organs, and in either case add their mite to the general sense of strain coming from the muscles of the whole body. The type of expectation which arises under the conditions of this situation may properly be called *Definite Expectation*, in distinction from *Indefinite Expectation* which arises under the conditions of the second situation.

In the second situation, there comes into consciousness a perception which has not been wrought by experience into a definite series. In common parlance one would say, in such cases, that one expected something but did not know what.

Experiment shows the same inhibition of breathing and of other muscular activity, the adjustment of sense organs, as in definite expectation; and the constituents of consciousness are, as in the other case, chiefly strain and organic sensations. For example, in the indefinite type of reaction experiment, the stimulus may not have been known and the action that was to take place may not have been known, but the organism was in the same tense state, ready to receive *some* impression and ready to make *some* response. The conscious constituents were essentially the same as in the conditions in which the character of the impression and response was known.

The ordinary use of the term expectation, as well as our experimental analysis of consciousness, warrant the extension of the term to include both of these cases. In fact, the structural analysis of the conscious types gives, in strictness, no warrant for making even the distinction that we have made. The type of consciousness is the same, whatever the situation. There is no psychological reason for making two classes of expectation; there is only the difference in the two situations, and to this difference we attach little importance. There is, however, another reason why we have mentioned this difference in situations which give rise to the state under discussion. It is evident that psychologists have not taken properly into account what we have called indefinite expectation; for, if they had, they would never have emphasized the importance of the image of the coming impression. In indefinite expectation, one cannot know what the image of the coming impression is, since one is ignorant of the nature of the coming impression. But our experiments show that the structural type of consciousness is essentially the same, whether the conditions of expectation are definite or indefinite. Therefore the image, as a distinctive characteristic of expectation, falls to the ground. The only structural difference is in the localization of strain sensations, in cases in which action follows the impression that comes after the initial perception. In definite expectation, the strain may be from the reacting finger, whereas in indefinite expectation the strain is more or less general. There is in both cases a general strain but, in the definite type of expectation, there may arise very definite sensations from the particular muscles that are tense and ready to contract when set off by the coming definite impression. This coming definite impression need not, however, be in consciousness in the form of an image. It may sometimes be there; but our experiments certainly show that it need not be there. The definiteness consists not in conscious clearness but in the definiteness of the preparation for the impression. It will serve to set off only



the particular reaction. It is not the image of the coming impression but the initial perception that throws the body into the attitude, which gives rise to the characteristic consciousness which we call expectation. In very few of the experiments with any of the observers was the image a prominent factor. Even when images were present, they were seldom images of the coming impression.

In ordinary memory, that is, in cases in which a perception is followed by an image, organic and strain sensations may also be present; but such a state is quite different from the expectant state. In the case of memory it is the image, not the perception, that introduces the organic and strain sensations. The name of a certain man, for example, may call up his image and an occasion when he insulted me, and I may then have organic and strain sensations; but the pattern of this latter state is entirely different from that of the expectant state. This state runs: perception, image, organic and kinæsthetic sensations. And not only do the image, and the ideas clustering around it, form the nucleus of this state, but it is largely a different set of organic and kinæsthetic sensations that surround the nucleus. They are not from the muscles adjusting sense-organs and from a controlled breathing, but from the actual and perhaps violent movement of limbs, and from a violent disturbance of breathing and other organic processes; whereas in expectation, as has already been pointed out, the sensations are from inhibited movements and from partially controlled organic processes. And apart from this difference in contents there is the important difference of arrangement in the pattern of consciousness.

The fact that all the observers often reported sensations from breathing suggested the idea of taking breathing curves from them. We accordingly did so, from nearly all the observers. Without any exception, the curves show that in the expectant state voluntary breathing is arrested and that breathing proceeds under control; it becomes shallow and more or less irregular. We also took a large number of curves from Mr. C. R. Hugins, an undergraduate student who had not been an observer in the experiments and who did not know that his breathing curve was being taken. The curves were taken while the observer was performing the reaction experiments in all their variations. In all cases, these curves show a marked inhibition of breathing. We have, then, at least partial proof of the correctness of our distinction between expectation and memory. There is, surely, no doubt that in memory the image is an important factor and gives rise to the organic and kinæsthetic sensations when they are present, while in expectation the image is not an important or neces-

sary factor and the kinæsthetic and organic sensations are occasioned by the perception. There may still be cases in which a memory-form would approach expectation, and others in which expectation would much resemble pure memory. But any classification must take account of such intermediate forms.

While there is a type of consciousness which is properly called expectation, the word has another and more general use about which it may be well to inquire. We refer to such uses of the word as are illustrated in the statements: I expect to die; I expect to marry; I expect to graduate; I expect hard times, etc. When one makes such statements, does one have a specific type of consciousness? The answer to this question does not much concern us in this paper, and we have taken no account of it in the experiments. Analysis of such experiences in the writer's own case convince him, however, that whether or not they form a distinct type of consciousness, they certainly do not belong to the same class with such experiences as he has been experimentally studying. Any one can satisfy himself, by a continued introspection, that when one has such thoughts one has not the definite, simple type of consciousness which our experiments show. The thoughts do not begin necessarily with some definite perception, nor is the state essentially made up of organic and kinæsthetic sensations. For the writer, the contents of such states are almost entirely verbal ideas and visual imagery. We have seen, it is true, that the verbal idea may also be present in expectation; but its structural relation is different in the two cases. In real expectation, the verbal idea, as we have shown above, has a close relation to kinæsthetic sensations that come from the adjusting of sense organs, and often from other muscular adjustment. In the case of such thoughts as we have just mentioned consciousness is more like pure memory. The image plays an important part, and the kinæsthetic and organic sensations that may arise follow the image and are merely a reverberation of past experience. Functionally they serve no present purpose; they are, it appears, essentially emotional in nature; whereas in real expectation they have functional purpose, and are emotionally unimportant. These thought experiences, of which we have been giving examples, are probably much more closely allied to Belief than they are to such experiences as we have been studying. They stand structurally on a much higher plane than does expectation.

What, now, are we to say about such treatments of expectation as those described in the first part of this paper? In the main, we found the authors there mentioned defining expectation as preparatory attention. This definition is not only

inadequate, but not in agreement with the facts as we have found them.

In the first place, expectation is not an attentive as distinguished from an inattentive consciousness. If the absolute clearness value of the focal idea is to serve as criterion of degree of attention, then expectation is rather an inattentive than an attentive consciousness; for the focal ideas are so low in clearness value that they can hardly be remembered long enough to be described by the observer. If we are to consider not the absolute but the relative clearness of the focal constituents, there is still no reason for calling expectation a form of attention; for there is very little difference in the clearness of the constituents in an expectant consciousness. One might, with some exaggeration, say that an expectant consciousness *has no focus* but *is all background*. An expectant consciousness is like a picture whose central figure has been left out. Often in the experimental work, especially in the early part of it, the observers would report that their minds were "like a conscious blank." Later, more practised introspection revealed a mass of organic and kinæsthetic sensations low in clearness value.

Especially those views which consider expectation to be attention to the image of the coming impression are not in accordance with the facts revealed by experiment. For, if there is any constituent of expectation that is usually inconspicuous and unclear, that constituent is the image or idea of the coming impression. Whatever one's view as to the nature of attention, one can hardly hold it possible to attend to that which is not at the time in consciousness.

There is a sufficient functional reason for the fact that an expectant consciousness is, so to say, all background, not only with no definite image, but also with no very clear sensational elements of any kind in the focus. For, from the standpoint of function, expectation is a preparation for a coming impression and for the reaction of the organism to the impression. Now, upon the appearance of some initial perception the organism 'sets' for the reception of the impression signalized by the perception and for the reaction to that impression, and very clear or intense processes or strong feelings would delay the assimilation of the impression and the co-ordinated reaction. Here, then, is an *a priori* argument which adds its weight to the facts as found by experiment.

There is, however, another reason that might be advanced for calling expectation a form of attention, a reason that has doubtless had an influence in the past. This is the fact that the bodily attitude is the same in expectation and in active attention. There is, in both cases, the same tenseness of the

muscles of the body in general and of those connected with the sense organs in particular. But the resemblance is only external; the conscious patterns are different. In active attention, perceptions (or ideas which functionally take their place) form the focus of consciousness, and the kinæsthetic and organic sensations are secondary. In expectation, the perception or idea is absent, and there is only a mass of kinæsthetic and organic sensations.

In active attention, the mind is all *now*; it has no future reference. In the focus are perceptions and ideas now in process. In expectation, a perception<sup>1</sup> realizes an *Aufgabe*.<sup>2</sup> The organism is thrown into a 'set,' an attitude, whose conscious parallel is to be found in the organic and kinæsthetic sensations. The 'set' gives the consciousness of the moment its future reference. There is nothing in attention as such to give it this reference; and when the reference is introduced, attention therewith changes to expectation; consciousness loses its focus, which constituted the essential characteristic of attention, and becomes all background, the processes aroused by the *Aufgabe*. On the other hand, when the *Aufgabe* sinks below the conscious level, consciousness loses its expectant character. Illustrations of this fact were found above in the experiments with sentences. Such a degeneration of the *Aufgabe* results from long association and habituation.

Whether, then, we look at the question from the structural or from the functional standpoint, it does not seem adequate or in accordance with the facts to define expectation in terms of attention.

Apart from the above criticism, however, Külpe gives us a description that is not very wide of the facts, so far as the constituents of the expectant consciousness are concerned, when he says that the specific characteristics of the expectant consciousness are certain complexes of organic sensation. If one gives up the attentional reference, one may very well consider expectation, from the purely functional point of view, as a preparation for a coming impression, for that is certainly the function performed for the organism. But the question of pattern or type of consciousness, as such, has nothing to do with the question of function, although this latter question

<sup>1</sup>We have not raised the question whether a central process, an idea, may initiate expectation. There is no *a priori* reason against such initiation, but we doubt whether an idea really does, as a matter of fact, often serve to initiate an expectant consciousness. The author has completely failed to find, in his own case, an example of such central initiation.

<sup>2</sup>For this specific use of the word *Aufgabe*, the reader may be referred to H. J. Watt, *Exper. Beiträge zu einer Theorie des Denkens*, *Arch. f. d. ges. Psych.*, iv, 1905, 289 ff.

is important in itself and we have given it consideration above.

Sully, it will be remembered, says that a succession of impressions must previously have taken place, in order that one member of the series may call up the idea of the next, and cause the next to be expected. Yes, if expectation means attention to the *idea* of the next; but if we take account only of the structural type, indefinite expectation is equally expectation, and we may expect without expecting anything in particular. Although there may be logical objections to such a condition, there is no psychological objection. Besides, this 'idea' is in fact not important, either structurally or functionally.

Our contention that the idea is not an essential part of expectation is in direct opposition to the view of Wundt and Lipps that expectation is a state in which an idea is striving toward apperception. Since we do not find the idea to be an essential constituent of the expectant consciousness, we need not stop to discuss the question what such an idea would be like, as distinguished from other ideas not so striving. In reality, the activity-aspect of the expectant consciousness should not be over-emphasized. The state, while one of strain, is rather a strain that comes from inhibition than from activity.

There is no evidence whatever for classing expectation as an emotion, as Dewey and others have done.

It will now perhaps be well to consider Hitchcock's monograph somewhat at length. She says<sup>1</sup> that the purpose of her study is "to investigate the nature of the process [of expectation], the part it takes in the development of conscious life, its true relation to other mental activities and its consequent value in helping to determine our knowledge of the world and of ourselves." All these problems have been approached, however, without the performance of a single experiment. It will be seen that the author makes the assumption that expectation is a process. Her provisional definition is: "Expectation may be spoken of as a mental process or attitude in which certain ideas or images are regarded as substitutes for definite sensational contents which are to be experienced later" (9). Now a process and an attitude are different things; and if expectation is the one, it is either more or less than the other. And is it not a good deal to assume *a priori* that ideas or images can be regarded as substitutes for definite sensational contents which are to be experienced later? In what sense can images be regarded as 'substitutes' for sensations?

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<sup>1</sup> *Psych. Rev. Mon. Sup.* v, No. 3, 1903, 3.

The organism certainly does not react to images as it does to sensations.

Two ways are pointed out in which expectation varies: in vividness, and in definiteness. "It may be intense and vivid, accompanied by strong emotion making the whole organism tense and alive with nervous activity; or it may arouse no feeling, remaining in consciousness only as a passive and almost ignored factor. Again, expectation may vary in definiteness from the clearest, most distinct ideas to vague, formless premonitions of something other than the present experience, a bare consciousness that there is a beyond." This passage evidently means that expectation is a process, a factor among the factors that make up consciousness. It must then, in the mind of our author, be a process of definite quality which can vary in vividness, intensity and clearness. She proceeds to distinguish expectation from memory and constructive imagination. All alike are processes, and at the same time *references!* Memory "is usually defined as the reference of present ideas or images to past presentations within one's individual experience; so expectation may be defined as the reference of present ideas or images to future presentations within one's individual experience. We see that both alike deal with ideas or images. In the case of memory these ideas represent the sensations which, with their escort of images, at one time made up the significance of some immediate presentation or passing event. In the case of expectation the ideas present some sensational effect which shall at a later period become a present experience. We are awaiting, looking forward to a juxtaposition of circumstances that shall afford the stimulus for arousing the sensation for which we at present substitute the image. The same image may then serve in the case of memory to recall an experience and in the case of expectation to foreshadow it. If this be true, how is it that we do not confuse the two states? Whether we are to refer the image to the past or to the future is largely determined in each case by the supplementary contents of the total psychosis" (9). But this discussion of the reference of the image to the future or to the past lapses when we learn that the image is not the important thing in expectation and indeed is usually absent.

Continuing her analysis (16), the author calls expectation an ideational process in which certain constituents are always found to be present. These constituents are "central idea, ideational and sensational factors with their attending feelings, and the definite time relation to the presentative element." This we understand to be her definition from the standpoint of structure, and we interpret it to mean that expectation is a name

to be given to a central idea that has as supplements ideational and sensational factors, feelings, and a relational element. This relational element relates the central idea to the presentative element *not yet in consciousness*. The sensational element is made up of kinæsthetic and organic sensations. On the latter point the author is correct, except that these sensational elements usually constitute the whole of the expectant consciousness.

At the beginning of chap. iii, we find a new definition. The author has already called expectation a process, a reference, and an attitude. Here we find that expectation is "the incipient response of the organism to the demands of some new situation." This, of course, cannot be a psychological definition; it is rather biological. But in psychological terms it would mean that expectation is kinæsthetic sensation. The author's 'supplementary' part becomes primary. From this biological point of view, she says that expectation begins in motor relations to a subjective stimulus which is in turn aroused by some perceptual form of consciousness. She explains that: "the central idea is identical with the subjective stimulus. The essential concomitants are supplied by the motor reactions, while the present situation, embodied in some perception, affords the external excitation of the process as a whole." The central image, she says, is always sensory, follows immediately after the sensation in immediate expectation, and introduces a perception. The ideational concomitants are of two kinds, sensory and motor. "The predominance of lively motor images, passing over into sensations, constitutes a large part of the difference between expectation and memory." We have already pointed out that this difference does not hold, that expectation is not essentially an active consciousness, opposed to memory as passive. Memory may have even lively kinæsthetic and organic sensations, whereas in expectation the strain sensation is from inhibition of movement rather than from movement; expectation is not essentially an 'active' consciousness. The difference is not so much that the one is passive and the other active; it is rather a difference in the kind of organic and kinæsthetic sensations, and their relation to the rest of consciousness. What these are, we need not repeat.

In order to get a better understanding of the author's idea, let us examine one of her illustrations. She says: "Suppose I see a flash of lightning, I expect to hear the peal of thunder immediately afterward. The image of the sound arises at once and forms the centre of the anticipation." Now the fact is that in the case of many—perhaps most—people there is no image of the thunder at all. In the writer's case, for example, there would be no auditory image of thunder. If the time in-

tervening between the flash and thunder were long enough, we should have kinæsthetic and organic sensations and perhaps verbal ideas.

Chap. iv contains a discussion of the relational factor. Such a chapter could hardly have been written by one who had done experimental work in this field. We find, in experiment, no evidence whatever for a 'relational element.' The formal discussion of *abcD* and *Dcef*, etc., is entirely speculative, and has slight relation to what one actually finds by an experimental analysis of the expectant state. The author speaks of the image as "thrown forward" in expectation, and of its being compared with the percept when the percept comes. Our experimental results show that nothing of the kind occurs.

We need not further notice Hitchcock's work. Her discussion of affective tone has little meaning, in the light of our present knowledge of feeling, and the same thing may be said concerning her discussion of the relation of expectation to other processes, and particularly of its relation to attention. Pains-taking and comprehensive as her treatment is, it fails of its purpose by reason of the lack of any experimental groundwork. The last part of the monograph treats of functional and logical aspects of the subject, and has less psychological interest.

To summarize, Hitchcock's idea is, briefly stated, that there is in expectation, first, a perception; this is followed by an image of an impression that had been, in the past, associated to the perception. The image has, as attendant elements, kinæsthetic and organic sensations, a relational element, and a feeling. The image gets its future reference from lively motor images and from the shifting of attention between perception and image. Our chief criticism of this analysis is that the image is not an essential element of the expectant consciousness, that consequently there is no play of attention between image and perception, and that there is no relational element to be found.

We add a few words regarding some recent experimental work. Watt,<sup>1</sup> in his *Experimentelle Beiträge zu einer Theorie des Denkens*, gives an analysis of the *Aufgabe*, the first period of the reaction experiment, corresponding roughly to what we have called expectation. Watt, however, speaks of expectation as if it were only a constituent of the *Aufgabe*, accompanied by strain sensations. And when the *Aufgabe* has degenerated, on account of repetition of the experiment, he describes it as consisting of bodily accommodation *and* a weak expectation. Our experiments seem to show that expectation is the conscious aspect of the bodily accommodation, not something in addition to it.

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<sup>1</sup> Archiv für die gesamte Psychologie, 1905, iv, 298 ff.



The introspections of Ach's<sup>1</sup> three observers for the fore-period of the reaction experiment correspond very closely with our own results; his observers, however, speak of expectation as if it were something in addition to strain and organic sensations and verbal ideas.

Messer's<sup>2</sup> observers report for the waiting period (*Vorbereitung*) of the reaction experiment chiefly verbal ideas and strain sensations. In addition, some of his observers report that they had a *weak expectation; an expectation that so and so would happen; expectation of the stimulus word; strained expectation; very strong expectation of what would come*, etc. The form or nature of this expectation is not stated. There is no analysis of it by any observer. With this exception, the reports of Messer's observers are in substantial agreement with our own.

In conclusion, let us bring together the results of our study. The experiments show that expectation is initiated by a perception, and that the perception is followed by kinæsthetic and organic sensations, and in some cases by verbal ideas. These sensational elements, following the initial perception (or possibly an initial idea), are the conscious aspect of an *Aufgabe* set up by the perception as the result of habit. Expectation is an habituated consciousness. The psychophysical organism 'sets' to meet an imminent situation; and, on the conscious side, this 'set' is expectation. On the physical side are: bodily attitude, strained muscles, inhibited breathing, fixed sense organs. The image of the coming impression may sometimes be present, but is not an essential factor, not a characteristic element. Although the bodily attitude is that of attention, the pattern of consciousness is not attentional, chiefly because it lacks a definite focus, and has the mark of futurity given by the *Aufgabe*. Functionally, the expectant consciousness exists not for itself but for a consciousness about to be. It therefore lacks definiteness and clearness. It is a preparatory, a transitional consciousness.

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<sup>1</sup> Über die Willenstätigkeit und das Denken, 38 ff.

<sup>2</sup> Archiv für die gesamte Psychologie, 1906, viii, 7-11.